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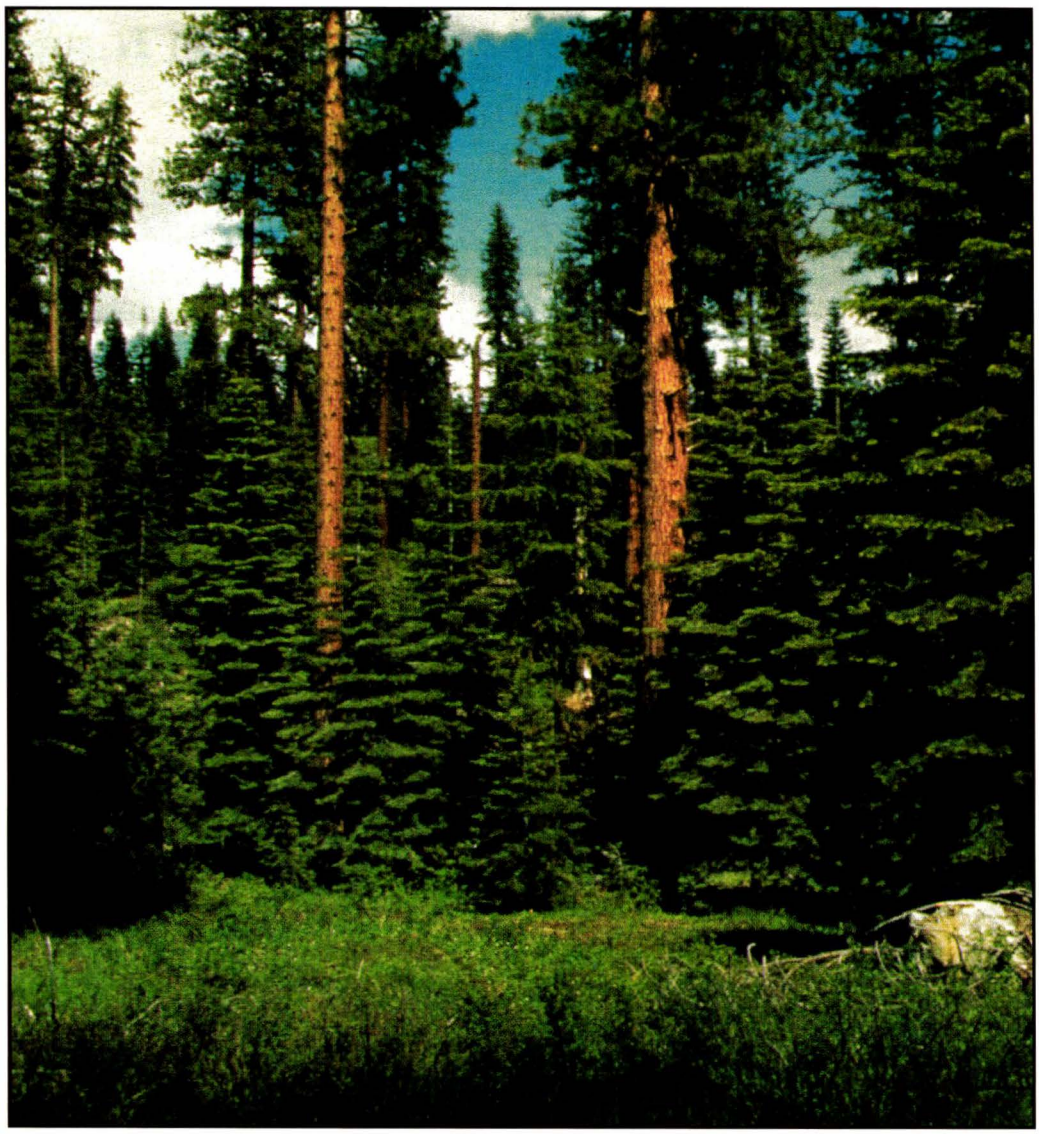
August 1996

Land Management Considerations in Fire-Adapted Ecosystems:

Conceptual Guidelines



"THE EARTH, born in fire, baptized by lightning since before life's beginning has been and is a fire planet."

—E.V. Komarek

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Land Management Considerations in Fire-Adapted Ecosystems:

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Ecosystems are not defined so much by the objects they contain as by the processes that regulate them.

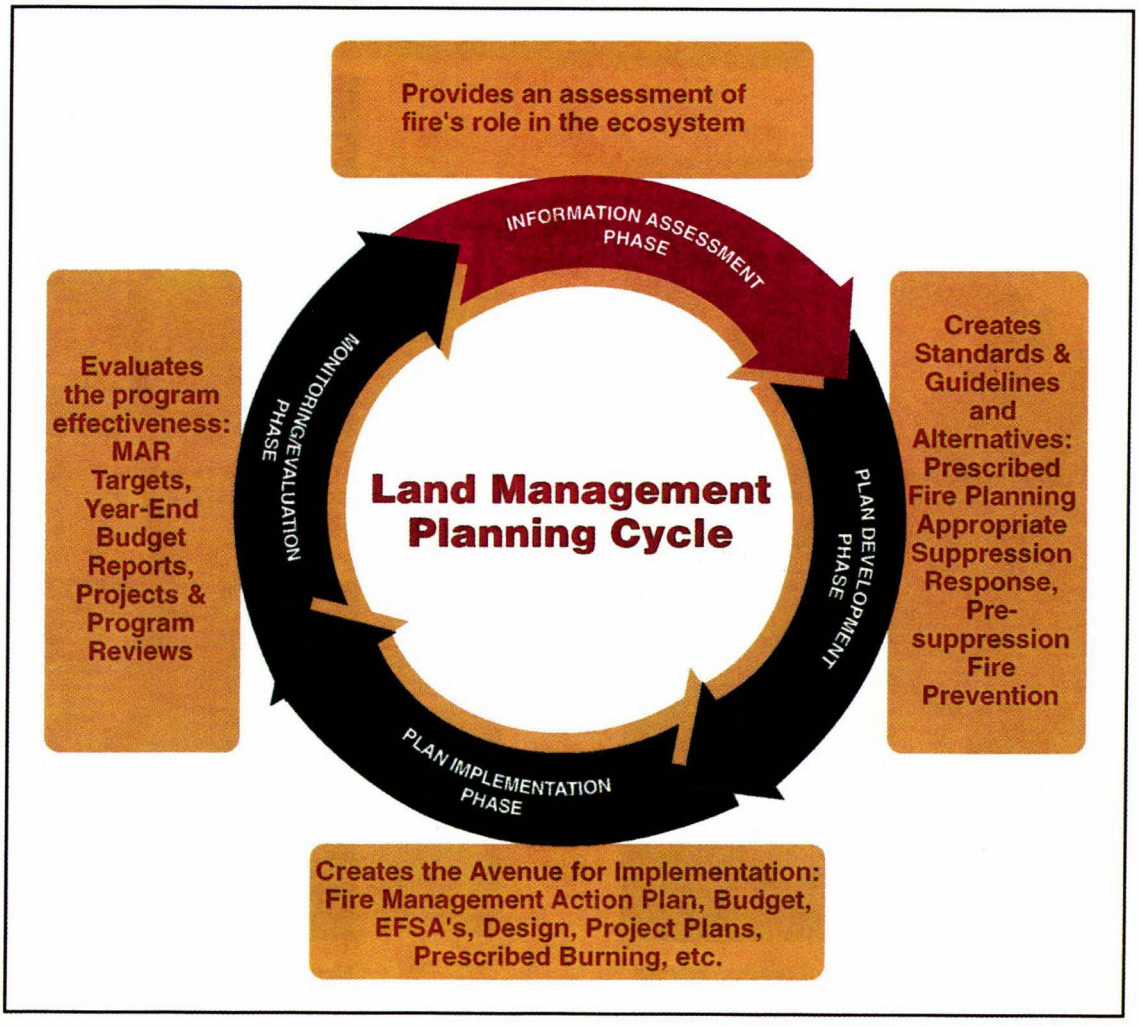
—Norm Christensen

Land Management Planning Considerations in Fire-Adapted Ecosystems:
Conceptual Guidelines

This **conceptual guide** is intended to increase the awareness of fire-related considerations among land management planners, fire planners, public affairs specialists, line officers, and interested individuals and organizations.

This guide will be used to establish the framework and foundation in the **Assessment Phase** of the Land Management Planning Cycle and to integrate **fire management considerations** into the succeeding steps of the Land Management Planning Cycle. Three other conceptual guides will follow:

- **Plan Development**
- **Plan Implementation**
- **Monitoring/Evaluation**


Provides an assessment of fire's role in the ecosystem
INFORMATION ASSESSMENT PHASE
Creates Standards & Guidelines and Alternatives: Prescribed Fire Planning Appropriate Suppression Response, Pre-suppression Fire Prevention
PLAN DEVELOPMENT PHASE
Land Management Planning Cycle
PLAN IMPLEMENTATION PHASE
Creates the Avenue for Implementation: Fire Management Action Plan, Budget, EFSA's, Design, Project Plans, Prescribed Burning, etc.
MONITORING/EVALUATION PHASE
Evaluates the program effectiveness: MAR Targets, Year-End Budget Reports, Projects & Program Reviews

Fire-related Considerations

The following fire-related considerations are important themes that need to be integrated into the land management planning process.

Fire suppression has a place in wildland management.

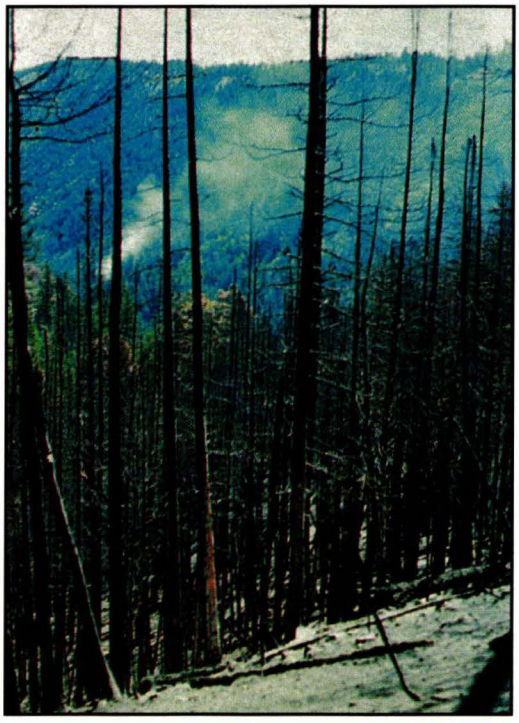
Fire exclusion has environmental and economic consequences.

Ecosystems are always changing. Fire is a major agent of change.

Using prescribed fire to meet ecosystem objectives results in social tradeoffs.

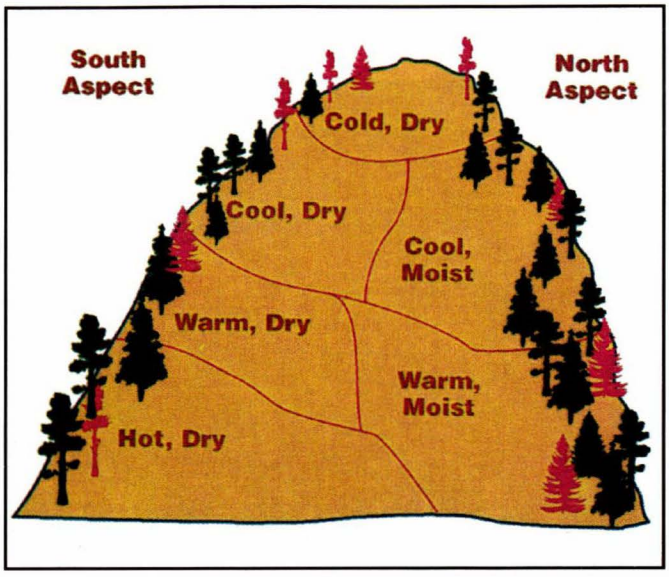
Ecosystems Are Always Changing. Fire Is a Major Agent of Change.

The role of fire on the landscape is change; the effects of those changes are defined by the FIRE REGIME. Fire regimes describe the varied and dynamic fire characteristics present in the ECOSYSTEM. Fire regimes exist along a spatial and temporal continuum, which determines the possible range of effects that can be produced by fire's interaction with ecological landscapes.

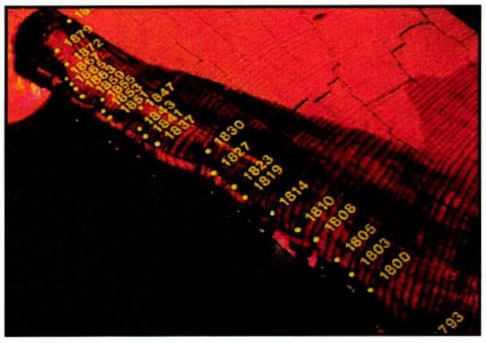


Changes in an ecosystem from biological influences, physical influences, or social influences can cause measurable shifts or changes in fire regimes.

Ecosystem changes resulting from biological and physical influences are referred to as DISTURBANCE. In ecosystems without disturbance, fire plays different roles on different sites along the MOISTURE/ TEMPERATURE GRADIENT.



Historically on warmer and drier sites, fires typically burned frequently and at low intensities. This type of fire regime is referred to as STAND MAINTENANCE. Examples are ponderosa pine communities in the West and longleaf pine communities in the South.



Years showing pine fire frequency.

On cooler and moister sites, fire burned less frequently but at higher intensities. This type of fire regime is referred to as STAND REPLACEMENT.

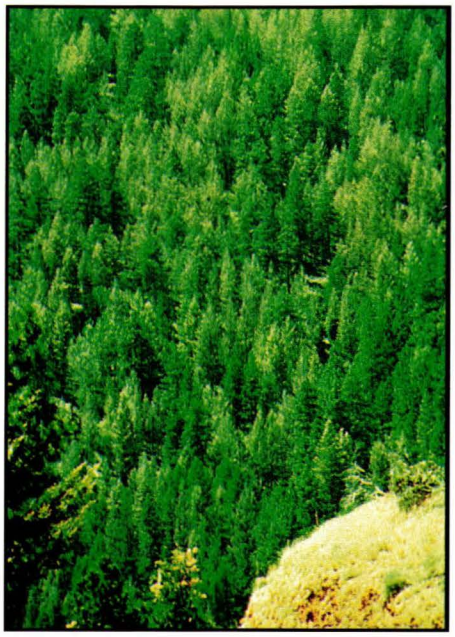
In FIRE-ADAPTED ECOSYSTEMS, significant changes in fire regimes have occured due to the prolonged absence of fire. These changes are first experienced in the short FIRE RETURN INTERVAL ecosystems because species composition and forest structure undergo rapid shifts when fire is excluded.

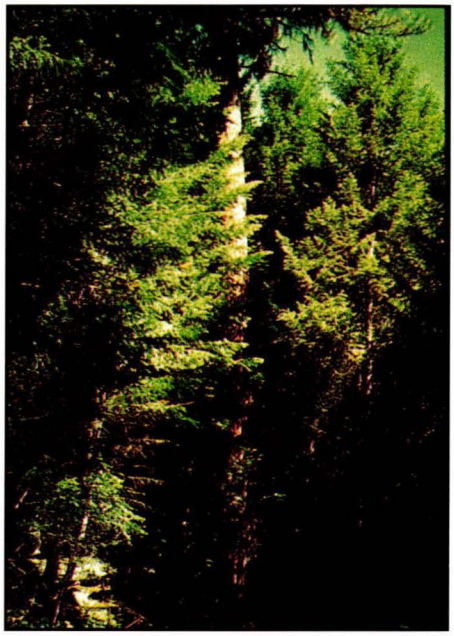
Sustaining SHORT INTERVAL FIRE-ADAPTED ECOSYSTEMS is emerging as an important challenge

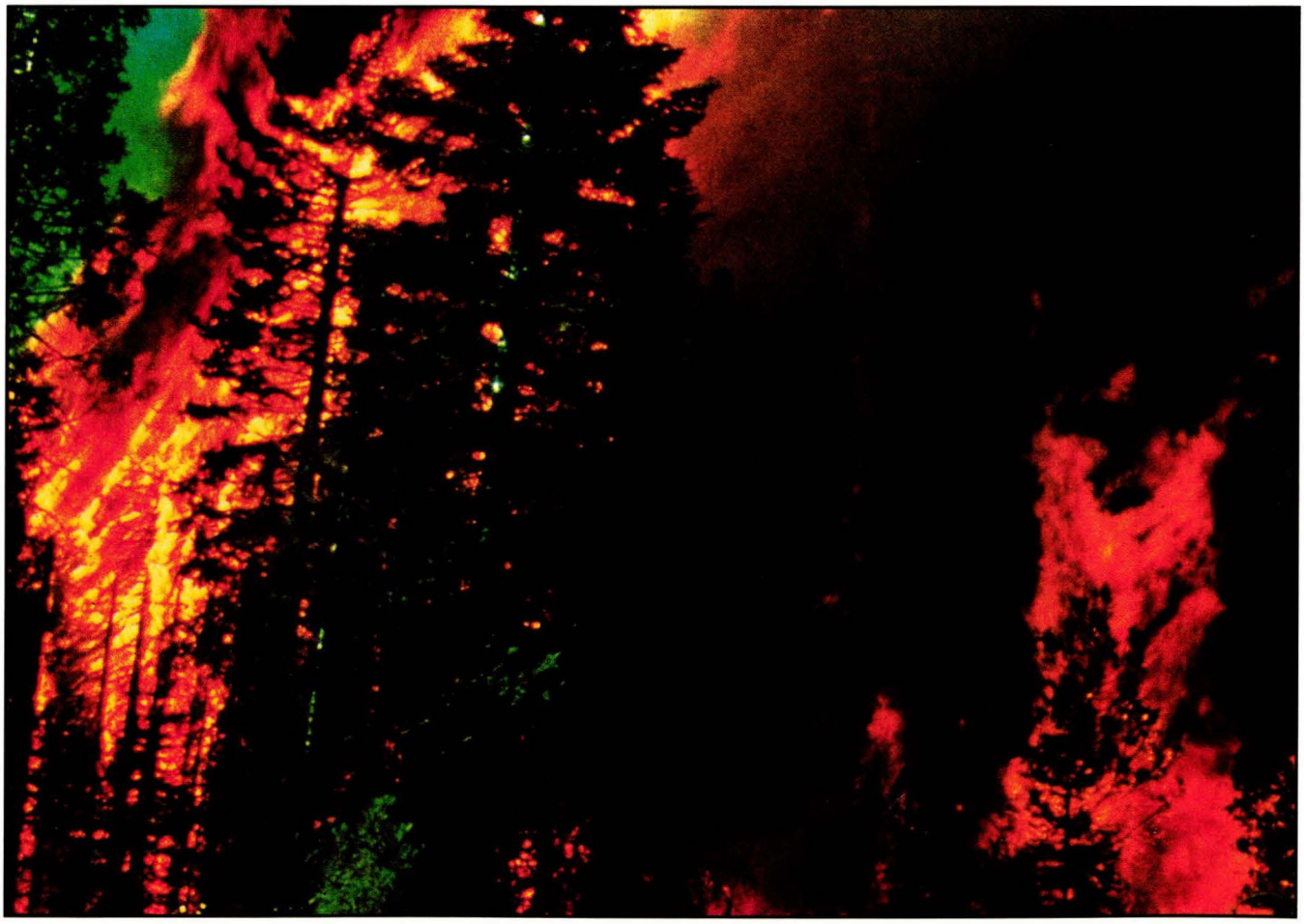
Succession

These photos show changes in species composition and ecosystem structure over time in the absence of low-intensity fire. Periodic surface burning maintained the open condition illustrated in the 1909 photo. All four photos are from the same field of view.

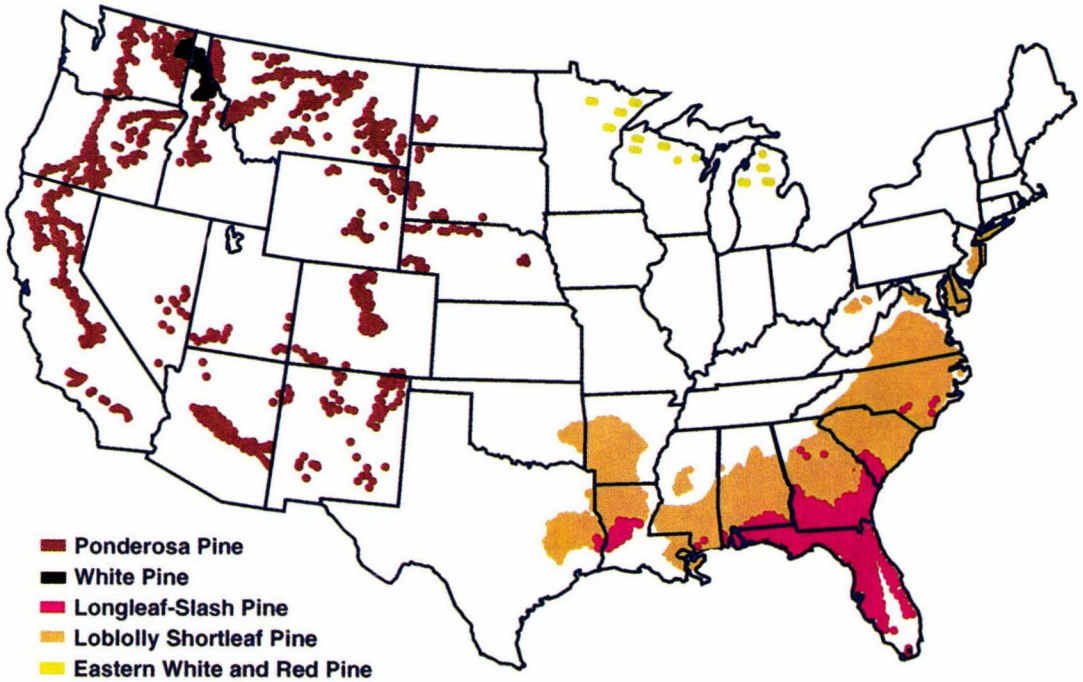
In short-interval fire-adapted ecosystems, successional changes have predisposed LATE SERAL STANDS to insect attack, disease outbreak, and severe high-intensity WILDFIRES.

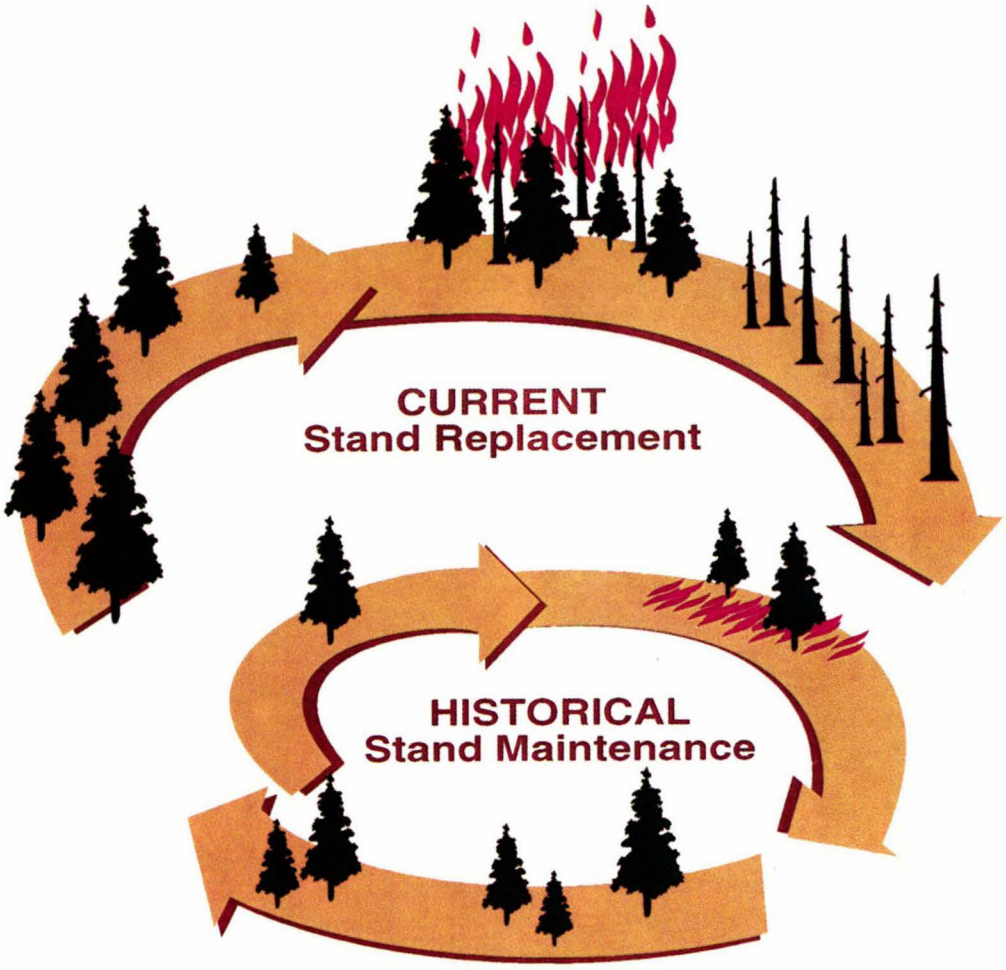






Historically, short interval fire-adapted ecosystems are characterized as having NONLETHAL surface fires with a fire return of less than 25 years. Long-needle pine types commonly represent this kind of fire-adapted ecosystem. The effects related to FIRE EXCLUSION have caused the fire regime to shift to a fire regime characterized by LETHAL stand replacement intensities and moderate to long fire-return intervals. (Refer to burning cycles in a long-needle pine fire-adapted ecosystem.) Nearly all significant forest health problems and many of the most destructive wildfires occur in these ecosystems, where fire has been excluded for prolonged periods and the natural fire regime has shifted. The extent of the problem is widespread as these ecosystems occur on nearly 30 percent of National Forest System lands.

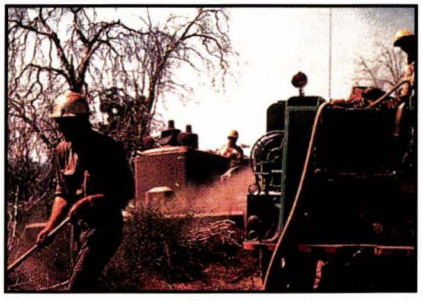




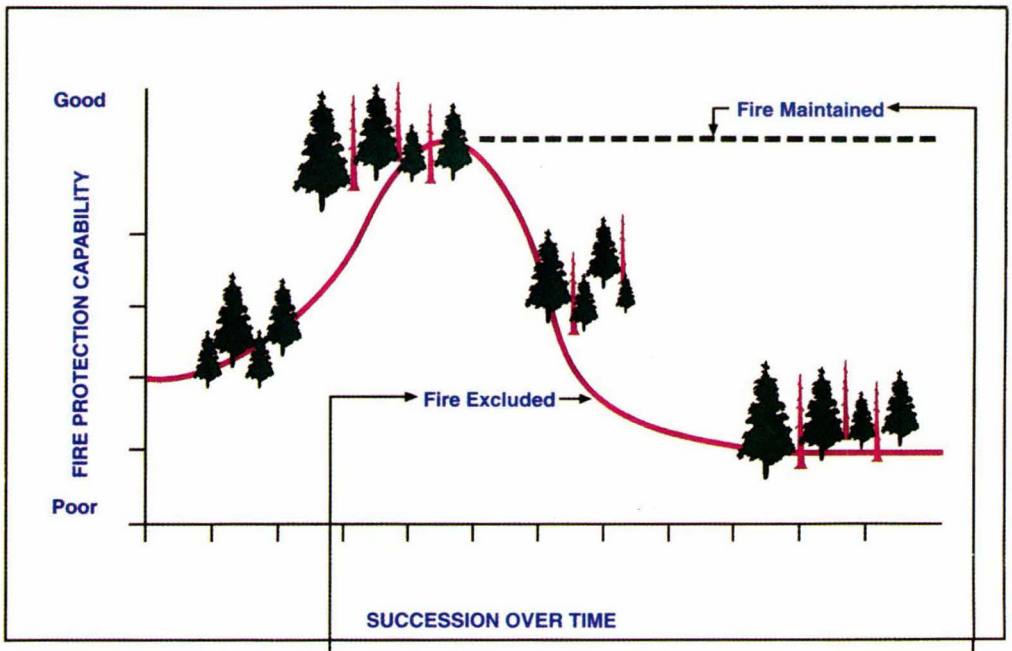
The burning cycle diagram illustrates the FIRE REGIME SHIFT from a stand maintenance to a stand replacement fire regime.

Fire Suppresion has a Place in Wildland Management

Fire suppression has an important place in wildland management. Forest Service mandate calls for commodity production and amenity protection. High value natural resources and private property in the vicinity of national forest lands require a capable and effective fire suppression organization.



Within short-interval fire-adapted ecosystems, suppression capabilities are limited and the economic costs are considerably higher when ignitions occur in LATE SERAL forest conditions.



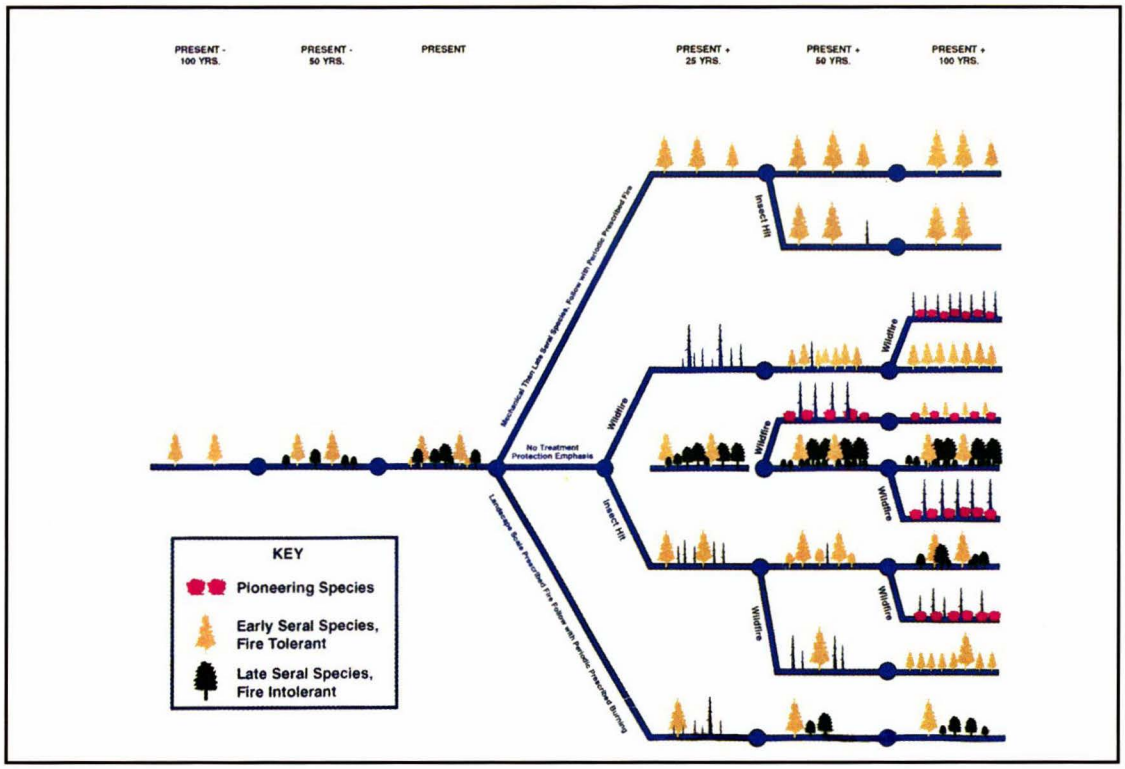
Forest condition representing high rates of fire spread and high resistance to control. (Fire excluded)

Forest condition representing low rates of fire spread and low resistance to control. (Fire maintained)

Fire Exclusion Has Environmental and Economic Consequences

The environmental consequences of fire exclusion are most apparent in short interval fire-adapted ecosystems. Stand replacement wildfires have displaced stand maintenance burning over wide areas of the country and have impeded our ability to provide outputs on a SUSTAINABLE basis (refer to Decision Tree.)

Projection of Possible Conditions in a Short Interval Fire-Adapted Ecosystem (Warm/Dry Habitat Group)

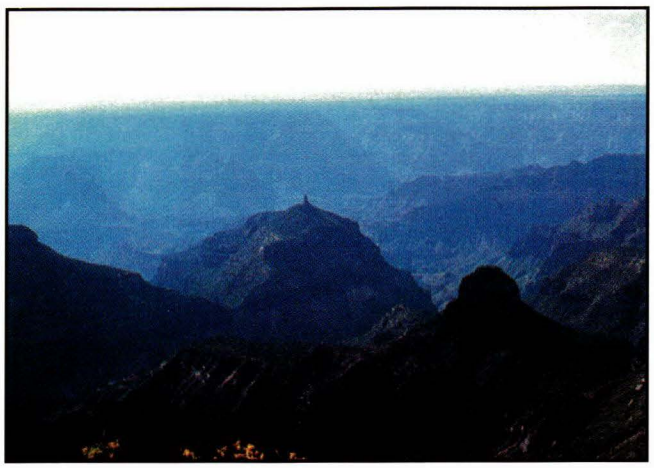


The Decision Tree, above, illustrates possible conditions and outcomes associated with various treatment alternatives. It assumes historical weather patterns, insects, disease, and fire will recur and focuses on scenarios expected to occur within 50-year intervals.

Using Prescribed Fire To Meet Ecosystem Objectives Results in Social Tradeoffs

PRESCRIBED FIRE can have important ecological benefits necessary to maintain fire-adapted ecosystem resilience and health, but its use can also result in social tradeoffs.

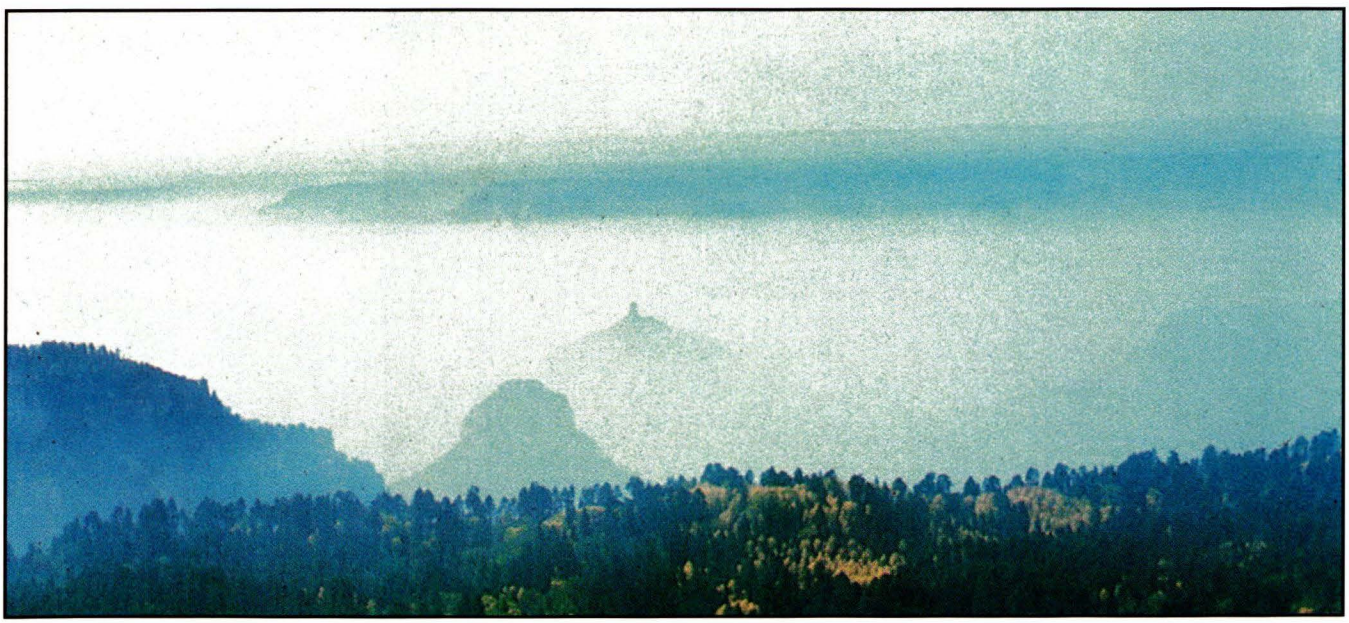
Smoke



- Although short interval fire-adapted ecosystems have evolved with fire and the smoke from fires, smoke impacts human health and impairs visibility.
- Land management planning can address the need to increase prescribed burning and, at the same time, improve air quality through better smoke management.
- The tradeoffs between smoke from prescribed fires and smoke from wildfires can be analyzed and needs to be displayed.

Risks

- Because an element of uncertainity is always present in the natural environment, some prescribed fires may escape and become wildfires.
- External and internal mechanisms favor short-term RISK avoidance. Risk avoidance is costly in the longrun.
- Land management planning can address how to identify, measure, and evaluate risk. Then, over time, resource managers can develop alternatives to reduce or mitigate risk. (Refer to Decision Tree.)

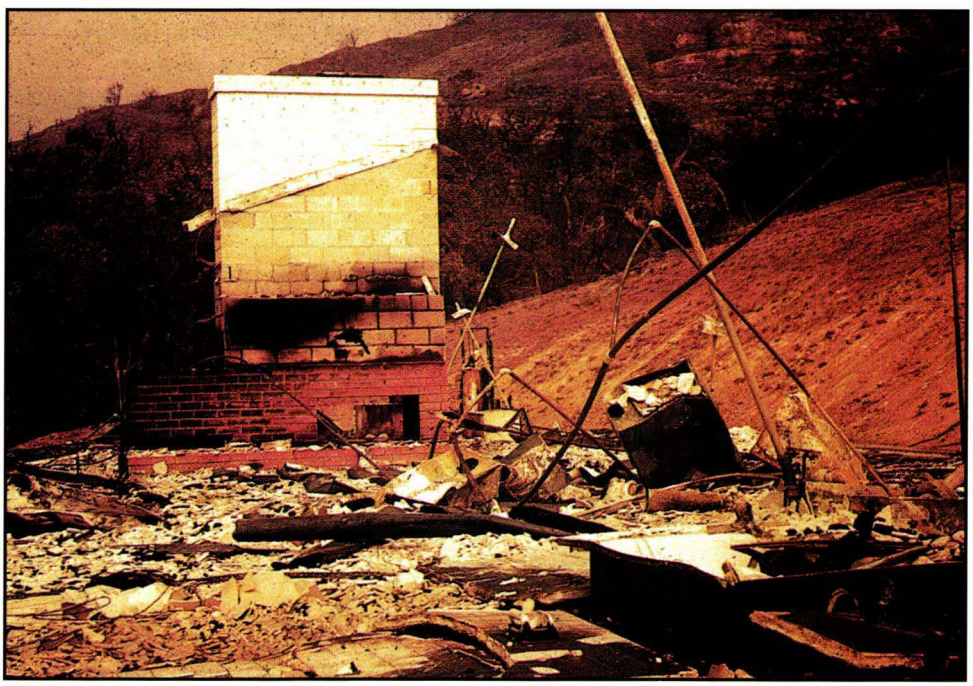


Healthy Ecosystems

- Fire is an essential process to the health and resilience of many ecosystems. Fire increases biodiversity.
- Public acceptance, smoke issues, and risk of escape constrain the expansion of prescribed fire programs.
- Land management planning should address education, information exchange, smoke management, and risk management.

Wildland-Urban Interface

- Development at wildland boundaries is expanding.
- Land management planning can address what is at risk from fire, and how the risk can be reduced.



Sample Checklist for Fire-Related Considerations in Land Management Planning

Information and Assessment Phase

- What are the natural fire return intervals and fire intensities of different forest ecosystems?
- Are there grassland, riparian, shrub, or forest ecosystems in need of restoration processes to improve their productivity or ecosystem health?
- Are there air quality considerations associated with smoke from prescription fire or wildfire?
- If wildfire occurs in the habitat of threatened, endangered, or sensitive species, will consultaiton with the appropriate agencies be needed?
- What is the status of the forest fire history information? Is GIS a possibility?
- Does desired condition address ecosystem structure, function, and species composition?
- Will these ecosystems be resilient over time from insect, disease, or high intensity stand-replacement wildfire?
- Are we working with local communities to minimize wildfire impacts?
- Are the consequences of fire exclusion being evaluated in fire-adapted ecosystems?
- Can prescribed fire be used to meet ecosystem objectives?
- How do fire suppression activities affect fire-adapted ecosystems?

Summary

This conceptual guide, Land Management Considerations in Fire-Adapted Ecosystems, provides baseline information for addressing fire management considerations in the Information/ Assessment Phase of land management planning. The fire-related considerations are:

- Ecosystems are always changing. Fire is a major agent of change.
- Fire suppression has a place in wildland management.
- Fire exclusiton has environmental and economic consequences.
- Using prescribed fire to meet ecosystem objectives results in social tradeoffs.

These considerations should set the foundation for the integration of fire, as an ecosystem process, into the development, implementation, and monitoring/evaluation phases of the land management planning process.

"The Earth does not belong to man, man belongs to the Earth. All things are connected, like the blood that unites us all. Man did not weave the web of life, he is but a strand in it; whatever he does to the web, he does to himself."

Glossary

DISTURBANCE—any relatively discrete event, either natural or human-induced, that causes a change in the existing condition of an ecological system.

ECOSYSTEM—An arrangement of organisms defined by the interactions and processes that occur between them. Ecosystems are often defined by their composition, function, and structure.

> **FIRE-ADAPTED ECOSYSTEM**—An arrangement of populations that have made long-term genetic changes in response to the presence of fire in the environment.
>
> > **SHORT INTERVAL FIRE-ADAPTED ECOSYSTEM**—Ecosystems experiencing low intensity surface fires with a fire return interval of less than 25 years. Examples include long-needle pine fire-adapted ecosystems such as ponderosa pine.

ECOLOGY—The study and science of the interrelationships between organisms and their environments.

FIRE EXCLUSION—The disruption of a characteristic pattern of fire intensity and occurrence (primarily through fire suppression).

FIRE INTENSITY—The rate of heat release (BTU/second) per unit of fire front.

FIRE RETURN INTERVAL—The number of years between two successive fires documented in a designated area.

> **FIRE REGIME**—The fire pattern across the landscape, characterized by occurrence interval and relative intensity. Fire regimes result from a unique combination of climate and vegetation. Fire regimes exist on a continuum from short interval, low intensity (stand maintenance) fires to long interval, high intensity (stand replacement) fires.

FIRE REGIME SHIFT—A change of the fire pattern across a landscape resulting from changes in climate and vegetation.

FIRE SUPPRESSION (FIRE CONTROL)—All of the work and activities connected with fire extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

LETHAL—A term applied to **stand replacement fires** emphasizing destruction of the living overstory.

> **NONLETHAL**—A term applied to **stand maintenance fires** emphasizing the survival of the living overstory vegetation.

MOISTURE/TEMPERATURE GRADIENT—Relationship of the change in value between moisture and temperature.

PRESCRIBED FIRE—A wildland fire burning under specified conditions that will accomplish certain planned objectives. The fire may result from either management or natural conditions.

RISK—The probability of the occurrence of a hazard and/or the consequences of that hazard (Hazards are undesirable events.)

SUCCESSION—The process of vegetation change, over time, following a **disturbance.**

SERAL STAND—Refers to a specific forest composition and structure following a disturbance. Patterns of vegetation, over time, are referred to as seral stages.

LATE SERAL STAND—The seral stage occurring late in a forward progression or sequence of vegetation changes.

SUSTAINABLE—The ability to maintain a desired ecological condition or flow of benefits over time.

WILDFIRE—Any wildland fire that requires a suppression response.

WILDLAND—An area in which development is essentially nonexistent, except for roads, railroads, powerlines, and similar transportation facilities. Structures, if any, are widely scattered and are primarily for recreation purposes.

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